

Short Note

A New Guadalupe Fur Seal Colony in the Gulf of California? Ecological and Conservation Implications

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The Guadalupe fur seal (*Arctocephalus philippii townsendi*; GFS) was hunted to near extinction by the late 19th century (Hubbs, 1956). Before exploitation, its population was estimated at around 200,000 individuals (Hubbs, 1979). It was widely distributed on islands off the coast of Baja California in Mexico and southern California in the United States (Peterson et al., 1968). Archaeological research indicates its range formerly included coastal areas from California and Washington (Etnier, 2002; Rick et al., 2009) to as far south as Socorro Island (Revillagigedo Archipelago), based on the logbook of the sealing ship, *Dromio*, from 1808 (Hamilton, 1951). In 1954, a few GFSs were found on Guadalupe Island, Baja California, Mexico (Hubbs, 1956), where recovering numbers have since been observed (Peterson et al., 1968). The GFS is currently protected as an Endangered species under Mexican law (NOM-059-SEMARNAT-2010) and a Threatened species under the U.S. Endangered Species Act; however, it is considered to be of Least Concern by the International Union for Conservation of Nature (Aurioles-Gamboa, 2015). Conservation efforts around the main breeding colony at Guadalupe Island have contributed to the recovery of the species, with a current population of around 40,000 individuals (García-Aguilar et al., 2018; Hernández-Camacho & Trites, 2018).

As part of this recovery process, the recolonization of the San Benito Archipelago (SBA), Baja California, Mexico, by 256 GFSs was reported in 1997 (Maravilla-Chávez & Lowry, 1999). The term *recolonization* is used to describe the SBA colony

because GFSs inhabited this archipelago in the past, but they were eradicated in the 19th century. This colony is almost entirely composed of sexually immature individuals (juveniles and male sub-adults) that migrate from Guadalupe Island mainly during the summer. For this reason, the low number of births at SBA is insignificant (Aurioles-Gamboa et al., 2010; Elorriaga-Verplancken et al., 2016b; Figure 1). The SBA colony grew consistently until at least 2014 when Elorriaga-Verplancken et al. (2016b) recorded a total of 3,710 GFSs followed by a marked decline (-60%) during the 2015-2016 El Niño warm water event.

GFSs undertake feeding trips up to 444 ± 151 km to their foraging grounds (Gallo-Reynoso et al., 2008), north into the California Current System and south of Guadalupe Island (Amador-Capitanachi, 2018; Norris & Elorriaga-Verplancken, 2019). Some GFSs have been recorded in the Gulf of Ulloa off the Baja California Peninsula (Aurioles-Gamboa et al., 2017) and the Mexican Central Pacific (Ortega-Ortiz et al., 2019), and both areas have been identified as likely GFS foraging grounds by those authors. Before this study, there were a few published records of extralimital individual GFSs in La Paz Bay or its surroundings in the southwest Gulf of California (Figure 1), including the sighting of six GFSs from 1985 to 2016 on the islet known as Los Islotes, which is the only California sea lion (*Zalophus californianus*; CSL) breeding colony in the southwest Gulf of California (Hernández-Camacho et al., 2008). Additionally, two GFSs have been found stranded on Espíritu Santo Archipelago

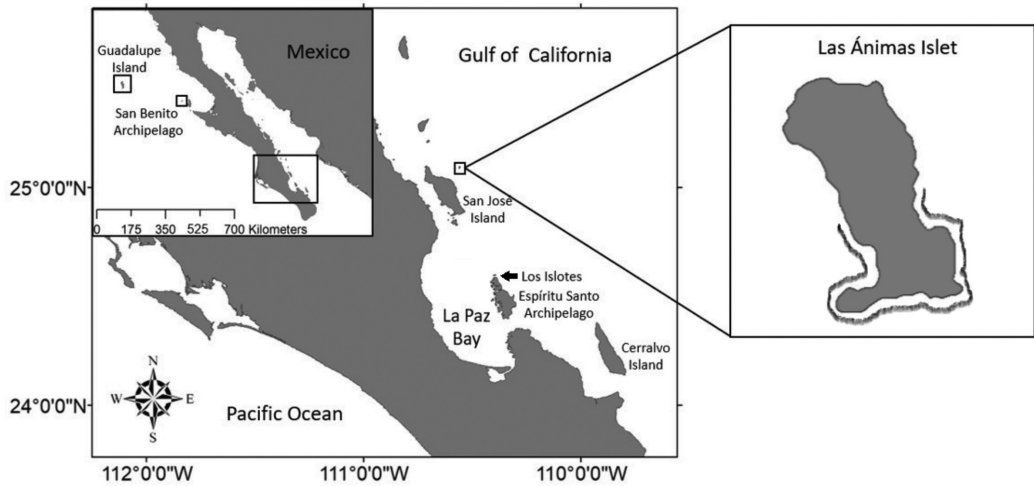


Figure 1. Map showing Las Ánimas Islet east of San José Island and north of La Paz Bay, southwest Gulf of California, Mexico, relative to the location of Guadalupe Island and the San Benito Archipelago. The black line along the southern portion of Las Ánimas indicates the main presence of Guadalupe fur seals (GFSs) on this islet, based on all records.

Table 1. Guadalupe fur seals (GFSs) sighted in the southwest Gulf of California from 1985 to 2020. For Las Ánimas Islet sightings, see Table 2. M = Male, F = Female, and ND = No data available.

Date	Age class	Sex	Number of individuals	Location	Co/author or source
20 July 1985	Subadult	M	1	Los Islotes (24° 35' N, 110° 23' W)	Aurioles-Gamboa & Hernández-Camacho, 1999
26 June 1986	Subadult	M	1	Los Islotes	Aurioles-Gamboa & Hernández-Camacho, 1999
16 May 1997	Subadult	M	1	Los Islotes	Aurioles-Gamboa & Hernández-Camacho, 1999
25 March 2015	Juvenile	M	1	Espíritu Santo Archipelago (24° 31' 50.8" N, 110° 22' 08.1" W)	Elorriaga-Verplancken et al., 2016a; live stranding
2 June 2015	Subadult male	M	1	Los Islotes	Elorriaga-Verplancken et al., 2016a
11 November 2015	Juvenile	M	1	La Concha Beach, La Paz Bay (24° 12' 07.7" N, 110° 17' 58.4" W)	Elorriaga-Verplancken et al., 2016a; dead stranding
17 February 2016	Juvenile	ND	2	At sea (24° 05' 09" N, 109° 36' 48" W)	MAW
18 February 2016	Juvenile	ND	2	Los Islotes	Elorriaga-Verplancken et al., 2016a
30 May 2016	Juvenile	ND	1	Los Islotes	FRE-V
15 March 2017	Juvenile	ND	3	At sea (23° 00' 06" N, 109° 33' 12" W)	MAW
3 August 2017	Juvenile	ND	1	Los Islotes	FRE-V
27 April 2018	Juvenile	M	1	Los Islotes	FRE-V
17 August 2018	Juvenile	ND	1	Los Islotes	FRE-V
27 May 2019	Juvenile	ND	1	Los Islotes	FRE-V
27 February 2020	Juvenile	F	1	At sea (22° 49' 02" N, 109° 53' 48" W)	MAW

and La Concha Beach in La Paz Bay (Table 1). Some of them were emaciated, probably due to oceanographic warm anomalies in the eastern North Pacific that may have impacted their foraging habits and precipitated some of these dispersal events (Aurioles-Gamboa & Hernández-Camacho, 1999; Elorriaga-Verplancken et al., 2016a). Herein, we report additional vagrant GFS sightings for the southwest Gulf of California: five sightings on Los Islotes (Figure 2A) from 2016 to 2019 and three sightings of six individuals at sea (Figure 2B) from 2016 to 2020 (Table 1).

On 5 March 2019, an aggregation of fewer than 12 GFSs was first discovered on an islet known as Las Ánimas, located 12 km east of San José Island in the southwest Gulf of California, Mexico (25° 06' 42.4" N, 110° 30' 38.3" W; Figure 1; M. Carwardine, pers. comm., 28 August 2020; Table 2). Las Ánimas is a small (480 × 55 m) volcanic formation featuring rocky areas, irregular rocky beaches, cliffs, ledges, and different size boulders, which is typical GFS terrestrial habitat (García-Aguilar et al., 2013; Arias-Del-Razo et al., 2016). Observations were made from boats using binoculars and photo-documented at variable distances between 10 and 70 m from the islet. GFSs were positively identified based on their long and pointed snout, abundant dark gray color, orientation of pinnae, active grooming, in-water postures, and characteristic vocalizations (Jefferson et al., 2015).

As part of an ongoing CSL abundance survey in and around La Paz Bay, a significant effort was made in 2019 by two of the co-authors (CJH-C and FRE-V) that included the various islands and islets of the region. Los Islotes and another haul-out islet site called San Rafaelito were surveyed on 15 April, 27 May, 19 June, 17 July, 22 July, 29 July, 3 August, 16–21 August, 8 October, 25–29 October, 13 November, and 26–27 November 2019. As a result, only one apparently healthy GFS juvenile

was recorded on Los Islotes on 27 May 2019. No GFSs were recorded when Las Ánimas was surveyed on 27 October 2019, which was the only visit to this site during the 2019 systematic surveys. The low number in March 2019 and their absence



Figure 2. (A) One of the juvenile GFSs sighted on Los Islotes (27 April 2018), and (B) one of the juveniles recorded at sea (27 February 2020) in the southwest Gulf of California (Photo credits: Fernando R. Elorriaga-Verplancken [A] and Marc A. Webber [B])

Table 2. GFSs and California sea lions (CSLs) at Las Ánimas Islet in the southwest Gulf of California, Mexico. Abbreviations of observers correspond to the co-authors of this study; ND = No data available.

Date	Total GFSs	GFSs hauled out	GFSs in the water	CSLs	Observer
5 March 2019	< 12	ND	ND	ND	M. Carwardine
27 October 2019	0	0	0	ND	CJH-C
18 February 2020	Present but no count	ND	ND	ND	M. Carwardine
28 February 2020	73	53	20	26	MAW
3 March 2020	57	ND	ND	ND	M. Carwardine
8 August 2020	> 100	ND	ND	ND	CRN
15 August 2020	119	95	24	69	FRE-V, AP-M

in October 2019 may provide evidence of an early stage of colony establishment.

Beginning 2020, an incipient GFS non-reproductive haulout was established on Las Ánimas Islet. This was observed on 18 February 2020, but a precise count was not performed (M. Carwardine,

pers. comm., 28 August 2020). Days later, on 28 February 2020, a total of 73 juvenile GFSs were observed and counted during circumnavigation: 53 hauled out (Figure 3A) and 20 resting and thermoregulating in the water (Figure 3B). On 3 March 2020, a total of 57 juvenile GFSs were

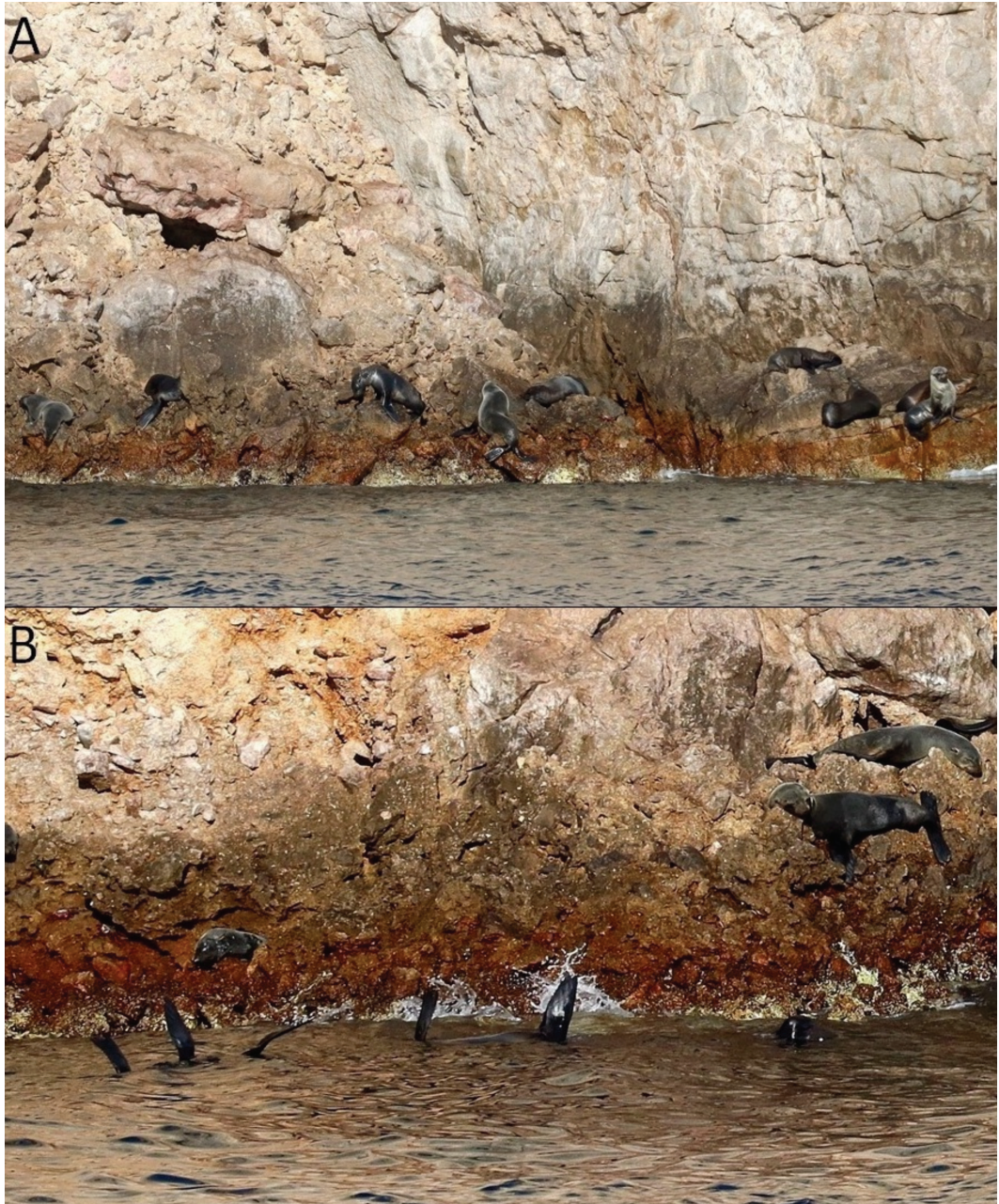


Figure 3. GFSs hauled out (A) and thermoregulating and resting in the water (B) around Las Ánimas Islet in February 2020 (Photo credit: Marc A. Webber)

counted (M. Carwardine, pers. comm., 28 August 2020). Later in the year, on 8 August 2020, a minimum estimate of 100 juveniles was reported. On 15 August 2020, a total of 119 juveniles

were recorded all around the islet but especially in the southern portion: 95 of them hauled out (Figure 4A) and 24 in the water (Figure 4B). This islet also was being used as a haulout by



Figure 4. GFSs hauled out (A) and thermoregulating and resting in the water (B) around Las Ánimas Islet in August 2020 (Photo credits: Aurora Paniagua-Mendoza [A] and Fernando R. Elorriaga-Verplancken [B])

approximately 26 CSLs during February and approximately 69 CSLs during August (Table 2).

The GFSs observed at Las Ánimas were juveniles, which is the dominant age class at the SBA recolonization site. However, an important difference is that the non-resident aggregation at SBA increases significantly from winter to summer (e.g., from 50 to 3,710 individuals from February to July 2014; Elorriaga-Verplancken et al., 2016b). Remarkably, the settlement at Las Ánimas has remained stable at a relatively consistent large size population, perhaps with a small increase between winter and summer 2020.

The first four months of 2020 had slightly high (0.5 to 0.6) El Niño Index values for Region 3.4 (5°N–5°S, 120°–170°W; National Oceanic and Atmospheric Administration [NOAA], 2020). These environmental conditions may have influenced the foraging effort of these GFSs, forcing them into this region in the Gulf of California (Elorriaga-Verplancken et al., 2016a). However, we do not believe that oceanographic anomalies are related to the GFS presence at Las Ánimas because vagrant otariid records related to anomalous environmental conditions usually involve sightings of lone individuals (e.g., Lander et al., 2000; Ceballos et al., 2010; Elorriaga-Verplancken et al., 2016a; Páez-Rosas et al., 2018), not large groups. Additionally, the GFSs at Las Ánimas did not show poor body condition; rather, they appeared to be healthy, unlike the five GFSs sighted in La Paz Bay during the 2015–2016 El Niño (Elorriaga-Verplancken et al., 2016a). We therefore conclude that this is an incipient colony that began at some point in 2019 or possibly at the beginning of 2020.

From 1984 to 2013, the total GFS population had a growth rate of 5.9% (range 4.1 to 7.7%; García-Aguilar et al., 2018); and, as a result, this Guadalupe Island colony is considered to be of Least Concern based on International Union for Conservation of Nature (IUCN) criteria (Hernández-Camacho & Trites, 2018). The new GFS colony at Las Ánimas could be related to this successful recovery as also suggested by the presence of individuals in waters off the Mexican Central Pacific during recent years (2010 to 2015; Ortega-Ortiz et al., 2019). Dispersion is an important component of colonization or recolonization for a pinniped species. This gradual process, which involves a first establishment by young individuals or first-time breeders, has been argued to take place when the density of breeding individuals at a given site reaches a threshold, causing a shortage of space that triggers emigration of these individuals to other suitable places (Roux, 1987; Bradshaw et al., 2000). This has been observed in other populations, including Southern

sea lions (*Otaria flavescens*; Grandi et al., 2008), New Zealand fur seals (*Arctocephalus forsteri*; Bradshaw et al., 2000), and gray seals (*Halichoerus grypus*; Reijnders et al., 1995), and also for the GFSs at the SBA (Auriolos-Gamboa et al., 2010). Additionally, these new places could also be related to the presence of alternative foraging grounds, as evidenced by Amador-Capitanachi et al. (2017), when they found GFS foraging differences between the colonies of Guadalupe Island and the SBA. Our findings from Las Ánimas highlight the value of these areas for the dispersal of juveniles and the potential creation of new colonies (Grandi et al., 2008) as well as for the use of new foraging grounds.

However, the GFS recovery process may include problematic scenarios that must be carefully analyzed such as the recent decline of the SBA colony (Elorriaga-Verplancken et al., 2016b), which is considered Endangered to Critically Endangered (only that colony) based on IUCN criteria (Hernández-Camacho & Trites, 2018), as well as the negative impact of recent warming anomalies on GFS foraging habits and neonate body mass (Amador-Capitanachi et al., 2020; Gálvez et al., 2020). Also, there is an ongoing unusual mortality event in the U.S. during which around 500 mostly emaciated recently weaned GFS pups stranded along the coast of California from 2015 to 2020, in addition to around 140 individuals along the coasts of Washington and Oregon in 2019–2020 (NOAA Fisheries, 2020).

These scenarios must be assessed independently and considered also in the context of their simultaneous occurrence. The incipient Las Ánimas GFS colony must be surveyed over time to assess its permanence progress and seasonal fluctuations, and to fully understand its role in GFS recovery. As part of that recovery, the recolonization of former sites like the SBA may take place, but so can the colonization of new sites like Las Ánimas in the Gulf of California where there are no historical records of GFS colonies. Thus, both continued monitoring and expanded investigation elsewhere are warranted.

The Gulf of California is a unique ecological setting that brings together a high diversity of marine mammals, including the only current resident pinniped, the CSL (Vidal et al., 1993). These two species (GFSs and CSLs) have different foraging requirements in the SBA where they coexist (Pablo-Rodríguez et al., 2015; Elorriaga-Verplancken et al., 2016b), but their foraging ecology should now be assessed in the southwest Gulf of California, where both otariids are apparently becoming sympatric, as well. A comparative dietary analysis should also be made between the GFSs at Las Ánimas and those on Guadalupe

Island and the SBA; this analysis may reveal insights into ecological differences or similarities among sites and the formation of GFS colonies.

Our findings and their implications are important not only in terms of research regarding the recovery of a marine mammal species hunted to near extinction, but also for their potential impacts to conservation and economics. Las Ánimas is part of a Natural Protected Area managed by the Comisión Nacional de Áreas Naturales Protegidas (CONANP; National Commission for Natural Protected Areas), which includes many islands and islets in the Gulf of California, including the Espíritu Santo National Park and UNESCO World Heritage Site located 60 km south of Las Ánimas. The presence of GFSs (protected as endangered under Mexican law and a conservation symbol of the Guadalupe Island Biosphere Reserve) in this region enhances the ecological value of the southwest Gulf of California. This is relevant because of a current increase in tourist activity around Las Ánimas that, if unregulated or unmanaged, may pose a threat to the development of this incipient GFS colony. This provides a unique opportunity to enact conservation and management programs that protect both this endangered species and the local economy.

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